

# Machine Vision Lighting Overview

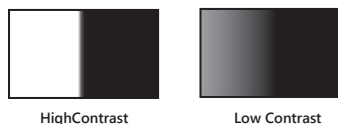
Generic lighting products are designed to provide basic illumination. However, lights designed for use as part of machine vision systems are designed with high-quality LEDs to provide consistent and uniform light across the desired field of view. Here are some considerations that should be kept in mind when designing an optimized machine vision lighting system.

## Goals for Machine Vision Lighting

### **Contrast**

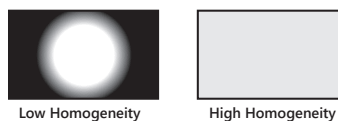
Maximizing contrast is the ultimate goal for any machine vision lighting system. If high contrast can be obtained, then detection is going to be a lot easier. In fact, maximizing contrast is the reason that most camera vision applications are monochrome. Contrast in monochrome images makes image processing easier.

To achieve the best contrast, the user must have a balance between homogeneity and brightness.



### **Homogeneity**

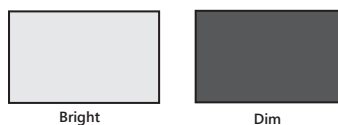
Homogeneity can be thought of as uniformity. The light needs to illuminate the whole field of view uniformly. Hot spots or dark spots remove contrast from specific regions of the field of view and can adversely impact vision accuracy, while a homogenous (uniform) field of illumination can greatly enhance accuracy.



### **Brightness**

Brightness, which is essential in creating contrast, is important in machine vision systems.

By increasing the brightness, system designers can create more robust systems using shorter exposure times. As an added benefit, this will also reduce motion blur.



It is true that if you put more current through an LED, it will get brighter. But one of the worst things for an LED's lifespan is over-current. Even though more current means a brighter LED, that brightness comes at a cost, for the brighter the LED gets the more heat is generated and the more its lifespan is reduced. In other words, the lifespan of an LED is directly related to the current through the LED.

The manufacturers of our machine vision lights have taken great care in selecting the brightest and highest quality LEDs. They have also carefully engineered these lights to maximize light output and LED lifespan in order to deliver a product that will work consistently well for a long period of time. For instance, in order to achieve higher brightness, some of our lights can be strobed with higher current. In these lights, built-in microprocessors manage strobe duration to maximize brightness without adversely impacting life expectancy of the LEDs.

## Dealing With Ambient Light

One of the hardest things to design out of a machine vision application is interference with your controlled lighting coming from unwanted ambient light in the location where the system will be used. Ambient light varies greatly from location to location, so designers must keep potential ambient light impacts in mind when designing machine vision lighting systems.

A common misconception is that ambient light comes only from overhead. However, the truth is that ambient light can come from several sources. Among the conditions which can impact ambient lighting are sunlight through a window, the reflection off of a reflective surface, or even a shadow.

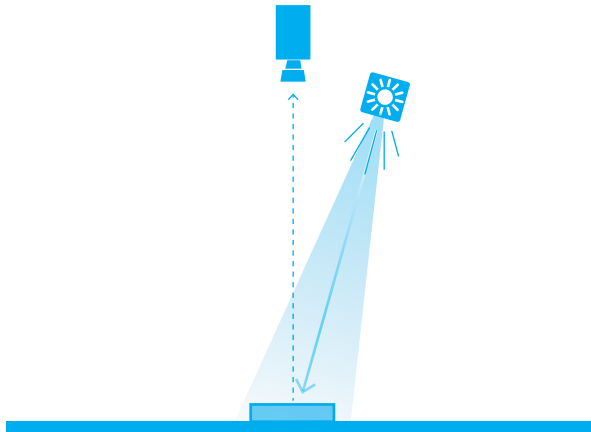
There are situations in which building a shroud around the inspection area is the most appropriate way to deal with ambient light. In other situations, the best way to deal with it is to increase the brightness of the light source.

Another solution to deal with ambient light is to use a specific color (wavelength) of light along with a corresponding filter to only allow that color of light to pass through to the camera. For example, when using a red light (625nm), you can use a 625nm bandpass filter to block out unwanted ambient light of other wavelengths.

# Machine Vision Lighting Overview, continued

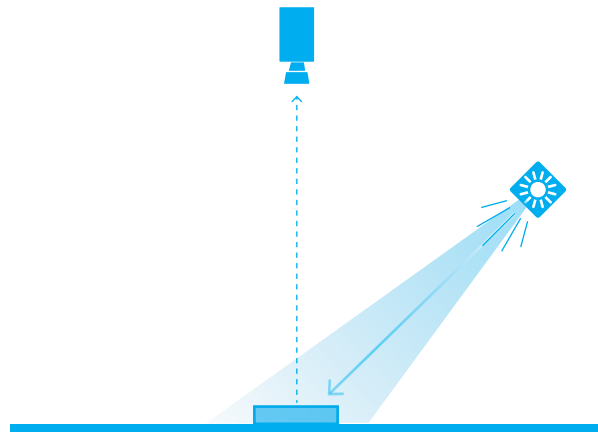
## Lighting Principles

Effective machine vision lighting relies on several factors, including what is known as the “angle of incidence.” Angle of incidence is defined as the angle at which the light strikes the object being illuminated. This angle is measured from an imaginary line between the camera and the light source. The examples below illustrate how different lighting angles can be used in various applications.



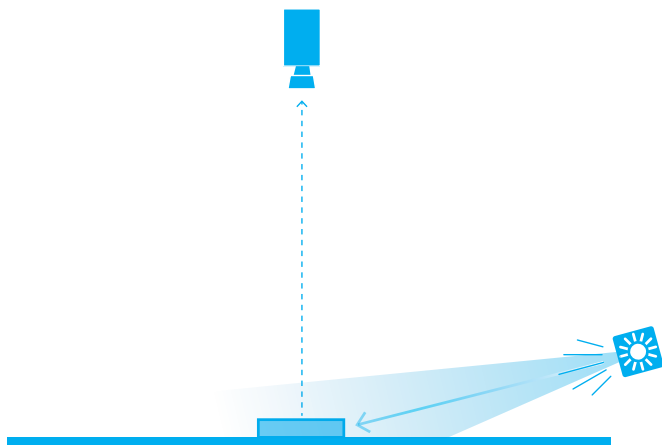
### **Bright field**

- Usually, the angle of incidence is between 0 and 30 degrees.
- Bright field is the easiest type of lighting principle for humans to understand, because this is how we generally see the world. However, this type of lighting system may not be well suited for use where shiny parts are involved.
- Diffusers or polarizers might be needed to decrease the unintended direct reflections.



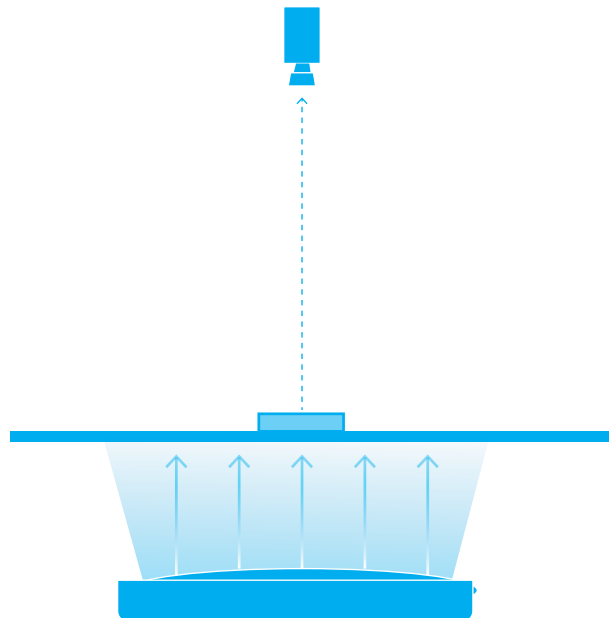
### **Low angle**

- Usually, the angle of incidence is between 30 and 80 degrees.
- The lighting source is placed between the dark field and the bright field so that the user can take advantage of both illumination methods.
- Good for engravings



### **Dark field**

- Usually, the angle of incidence is between 80 and 90 degrees
- This lighting configuration will generally bring high contrast to the edges. For parts that are not shiny, a narrow beam angle is usually best. For shiny parts, a diffused light source usually works best.
- Applications include edge detection and measurement.



### **Backlight**

- The light source is placed behind the object.
- When using this method, it is important that the light is bigger than the field of view.
- Backlighting light sources should be highly diffused and offer high homogeneity.
- Backlighting makes it possible to see a silhouette.

# Lumher Backlight Lighting (BD Series)

# lumher



**BD2PD5CY**

Lumher's BD (or backlight) Series combines mechanical design, robustness and homogeneity to achieve optimum results in your machine vision projects.

These backlights provide flicker-free illumination while preserving the luminous flux throughout the life of the product.

Optional mounting accessories allow these backlights to be installed at an angle of either 0° or 90°.

The product is made of anodized aluminium with IP65 watertightness and is available in two sizes.

## Features

- Robust aluminum body
- IP65
- Integrated controller
- Continuous only or strobe-capable models available

## Lumher BD Series Backlight Lighting Selection Guide

| Part Number                     | Price      | Light Emission | Illumination Area<br>(mm [in]) | Diffuser                         | Mode of Operation | Drawings                   |
|---------------------------------|------------|----------------|--------------------------------|----------------------------------|-------------------|----------------------------|
| <a href="#"><u>BD1PD5CY</u></a> | \$716.00   | White (5000K)  | 100 x 100<br>[3.94 x 3.94]     | Semi-diffused ( $\pm 30^\circ$ ) | Continuous only   | <a href="#"><u>PDF</u></a> |
| <a href="#"><u>BD2PD5CY</u></a> | \$992.00   | White (5000K)  | 100 x 190<br>[3.94 x 7.48]     | Semi-diffused ( $\pm 30^\circ$ ) | Continuous only   | <a href="#"><u>PDF</u></a> |
| <a href="#"><u>BD1ZD5CY</u></a> | \$924.00   | White (5000K)  | 100 x 100<br>[3.94 x 3.94]     | Semi-diffused ( $\pm 30^\circ$ ) | Strobe-capable    | <a href="#"><u>PDF</u></a> |
| <a href="#"><u>BD2ZD5CY</u></a> | \$1,200.00 | White (5000K)  | 100 x 190<br>[3.94 x 7.48]     | Semi-diffused ( $\pm 30^\circ$ ) | Strobe-capable    | <a href="#"><u>PDF</u></a> |

**24 V**  
DC

**IP65**

  
**M12A**

  
**MACHINE VISION**

**CONTINUOUS 1x**  
**STROBE 4x**

**INTEGRATED**  
  
**CONTROLLER**

  
**SEMI-DIFFUSE**  
**60°**

  
**MADE IN SPAIN**

# Lumher Backlight Lighting (BD Series)

# lumher

## Lumher BD Series Backlight Lighting Specifications

|                                         | Continuous Mode                                                                     | Strobe Mode                                                                                                               |
|-----------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Strobe Input                            | –                                                                                   | PNP: More than 22V for ON; Less than 1V for OFF<br>NPN: Less than 1V for ON; More than 23V for OFF                        |
| Overdrive                               | No                                                                                  | Yes                                                                                                                       |
| Strobe Conditions (ON time, duty cycle) | –                                                                                   | For first 10ms, 4X normal brightness; then normal brightness.<br>To re-engage strobe, LEDs must be off for at least 50ms. |
| Maximum Rising Time                     | 3μs                                                                                 |                                                                                                                           |
| Maximum Falling Time                    | 3μs                                                                                 |                                                                                                                           |
| Connection                              | M12 A-coded 4-pole connector                                                        |                                                                                                                           |
| Consumption                             | BD1 models: White: 7W<br>BD2 models: White: 14W                                     | BD1 models: White: 28W<br>BD2 models: White: 56W                                                                          |
| Minimum Functioning Voltage             | 22.8 VDC                                                                            |                                                                                                                           |
| Normal Functioning Voltage              | 24VDC ±5%                                                                           |                                                                                                                           |
| Maximum Functioning Voltage             | 25.2 VDC                                                                            |                                                                                                                           |
| Maximum Consumption Strobe Signal       | –                                                                                   | 1.5 mA                                                                                                                    |
| Maximum Strobe Duty Cycle               | –                                                                                   | 16%                                                                                                                       |
| Operating Temperature                   | -10°C to 40°C [14°F to 104°F]                                                       |                                                                                                                           |
| Operating Maximum Humidity              | 80% without condensation                                                            |                                                                                                                           |
| Weight                                  | BD1 models: 500g [1.10 lb]<br>BD2 models: 796g [1.75 lb]                            |                                                                                                                           |
| Materials                               | Body: Anodized aluminum<br>Side cover: Anodized Aluminum<br>Diffuser: Polycarbonate |                                                                                                                           |
| Storage Temperature                     | 0°C to 60°C [32°F to 140°F]                                                         |                                                                                                                           |
| Lifespan of LEDs (ON time)              | 6.8 years                                                                           |                                                                                                                           |
| IP Protection                           | IP65                                                                                |                                                                                                                           |

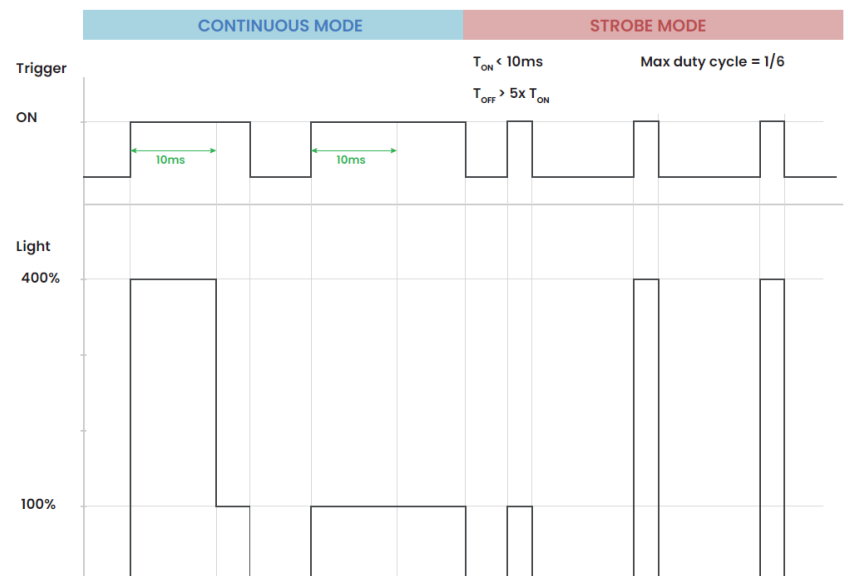
## Connections

| M12 A-Coded Connections   |                        |                       |
|---------------------------|------------------------|-----------------------|
| Pin Number and Wire Color | Continuous-Only Models | Strobe-Capable Models |
| Pin 1 – Brown             | +24VDC                 | +24VDC                |
| Pin 2 – White             | Not Connected          | Trigger NPN           |
| Pin 3 – Blue              | 0VDC                   | 0VDC                  |
| Pin 4 – Black             | Not connected          | Trigger PNP           |

## M12 A-Coded Male Connector



## Timing Chart

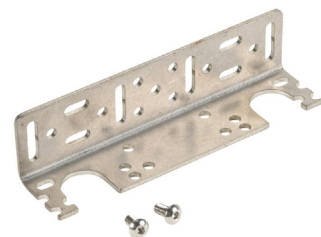


# Lumher Mounting Accessories For RD, BS and BD Series Lights

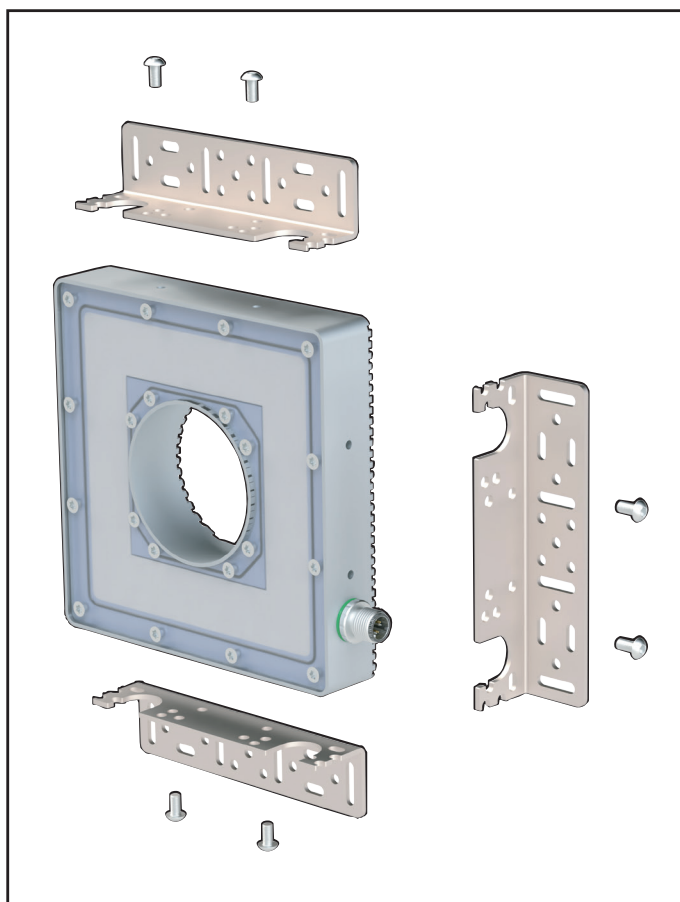
**lumher**

## Lumher RD, BS and BD Series Mounting Bracket Selection Guide

| Part Number         | Price   | Material        | Mounting                                                                                        | Drawings            |
|---------------------|---------|-----------------|-------------------------------------------------------------------------------------------------|---------------------|
| <b><u>B00S1</u></b> | \$16.50 | Stainless steel | For mounting lights: Use supplied screws<br>For mounting brackets: Use customer-supplied screws | <a href="#">PDF</a> |

**B00S1**

### Mounting Assembly for B00S1 With RD Series Light



### Mounting Assembly for B00S1 With BS or BD Series Light

